#### **Nuclear Energy University Programs**

**Small Modular Reactors** 

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#### SMR Overview

#### Program Mission:

- Conduct research, development, and demonstration (RD&D) activities supporting the development and deployment of advanced small modular reactors (SMRs)
- Support the accelerated licensing and deployment of firstmover SMR designs

#### Status:

- New program for FY 2011 (still pending)
- Strong government and industry support



## Workscope Description(s) Advanced Concepts

- Focus on concepts/designs that expand opportunities for nuclear energy
- Include all concepts/designs beyond first-to-market
  - Next-generation LWR
  - Non-LWR
- Solicit innovative SMR concepts that meet desired functional requirements, such as:
  - "Bullet proof" reactor concepts
  - Multi-product power plants (co-generation)
  - Reactor systems for small or unstable grids
- Evaluate technical viability of selected concepts
- Identify and develop supporting technologies



# Workscope Description(s) ICHMI Pathway

- Address different design and operational aspects
  - New sensors and measurement systems for integral/pool designs and SMR-specific environments and conditions
  - Advanced control rooms and control architectures for multi-module operation
  - Diagnostics and prognostics methods for extended refueling cycles
- Address opportunities for further improvement in affordability
  - Increased automation and in situ monitoring
  - Expanded use of wireless communications
- Address needs for expanded functionality
  - Advanced controls for co-generation and grid-stabilizing operation



## Workscope Description(s) Assessment Methods Pathway

- Adapt/extend existing performance and safety analysis codes to SMRs
- Develop PRA capability for passive safety systems and unique operational aspects of SMRs (staffing, EPZ, etc.)
- Develop advanced modeling and simulation methods
- Construct advanced economic models for SMR fabrication, construction and operation
- Develop SMR-specific site assessment and screening tools
- Assess SMR features that can reduce proliferation risk



Pathway

- Examine material and fuel degradation phenomena due to SMR-specific conditions (e.g. low coolant flow)
- Evaluate materials and fuels for advanced SMRs (e.g. extended fuel burn-up and longer refueling cycles)
- Evaluate/extend code cases for SMR materials/fuels
- Establish a demonstration project for integrated manufacturing of SMR modules



# Workscope Description(s) Safety Assurance Pathway

- Develop advanced technologies for intrinsic safety and security
- Address issues identified in NRC SECY10-0034
- Collaborate with the Nuclear Energy Institute (NEI), American Nuclear Society (ANS) Special SMR Committee
- Coordinate with other organizations on SMR-related codes and standards (NESCC)



### **Grand Challenges**

- Validate the improved safety case of SMRs
  - Required for Design Certification and Construction/Operations License applications
  - Provides strong motivator for new customers
- Demonstrate value of factory-fabricated nuclear steam supply system (NSSS)
  - Impacts economic viability of SMR
  - Also impacts plant quality, construction schedule and inspection requirements
- Develop enabling ICHMI technologies
  - Required for expanded operational and economic viability

## SMR University R&D Interests

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- Advanced SMR concepts—expanding nuclear energy to more customers and applications
  - Understanding the technical and economic viability
  - Identifying technology gaps
  - Developing a technology roadmap
- Advanced technologies and methods—developing new capabilities and tools
  - Advanced sensors and instrumentation for SMR features and operations
  - Robust coolants, fuels and materials for severe accident response
  - Multi-physics simulation tools for SMR designs and conditions